Climate Model Downscaling for Regional Impacts Studies

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Studies of the regional impacts of climate change must confront the problem of choosing climate change scenarios as input for process models. Global climate models simulate conditions at too coarse a spatial resolution to represent surface features and atmospheric processes that are critical to understanding local impacts. In order to downscale global simulations for regional studies, several techniques have been developed. Broadly, these fall into two categories: Statistical Downscaling and Regional Models. Each has advantages and disadvantages that are highly relevant to particular applications.

The task of downscaling global climate model simulations is often so demanding that only a limited selection of models and greenhouse gas emission scenarios may be considered. However, it is preferable to consider a range of scenarios in climate impacts studies (see, for example, IPCC, 2001, page 741). Using multiple models allows a better representation of the uncertainties and range of possible outcomes. Most statistical downscaling methods are computationally efficient and permit a range of scenarios to be considered. For applications in water resources, statistical methods are often most appropriate.

However, statistical methods cannot adequately represent aspects of the climate system that may be important to a particular study. Properties such as details of the circulation or extreme events are better simulated by a regional climate model. A regional model can also represent fine scale meteorological responses to changing global conditions. For applications such as air quality or ecosystem modeling, a regional climate model might be most appropriate for downscaling.

In this talk, I shall provide an overview of downscaling methods for the pacific northwest and present recent results from statistical downscaling and regional climate modeling. The suitability of the results for various applications will also be discussed.